

OPTIMIZATION OF TEMPERATURE AND TIME OF DEEP FAT FRYING FOR QUALITY JACKFRUIT CHIPS

SATISHKUMAR¹ & KARTHIK, S. K²

¹Senior Research Fellow, UAS, GKVK, Bangalore, Karnataka, India

²Teaching Associate, CAE, PJTSAU, Sangareddy, Karnataka, India

ABSTRACT

Jackfruit (ArtocarpusheterophyllusL.) is an important underutilized tropical fruit which can be processed into several types of value added products. Chips, also known as crisps, are one of the popular and relished savory items that are prepared by deep fat frying technique. The quality of the chips mainly crispiness depends on frying temperature and time. An attempt was made to optimize the temperature and time for processing of good quality jackfruit chips. Three different genotypes of jackfruitviz., Mottama Varika, Swarnahalasu and Tane Varikawere used for processing into jackfruit chips. Fully matured, unripe and minimally processed bulbs of above genotypes were cut into finger like chips using a special chip cutterand were deepoil fried(using refined sunflower oil) at three temperaturenamely160, 180 and 200°C for 6, 7and 8minutes, respectively. The processed jackfruit chips were subjected for sensory evaluation using 5 point hedonic scale. The results of the study revealed that chips processed at 180°C for 7 minutes showed highest organoleptic scores with respect to colour(4.55), crispiness(4.3) and overall acceptability(4.22) compared to chips processed at other temperature and time. Among the three genotypes of jackfruit, the chips prepared from the genotype Tane Varika recorded highest organoleptic scores. The results clearly indicated that the quality of jackfruit chips is very much influenced by processing temperature and time.

KEYWORDS: Jackfruit, Jackfruit Chips, Minimal Processing, Deep Fat Frying

Original Article

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INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* L.) is a tree species from the family Moraceae. It is native to India and it grows wildly in the forests of Western Ghats of India (Reddy et al., 2004). Being a rich source of biodiversity for a number of plant species, Western Ghats harbour a wide diversity of jackfruit trees. Jackfruit is also grown in Bangladesh, Vietnam, The Phillipines, Burma, and Malaysia and to a considerable extent in Brazil (Samaddar, 1985). The jackfruit is an evergreen tree, producing more yield than any other fruit tree species and bears the largest edible fruits (Alagiapillai et al. 1996). It is still regarded as minor fruit and is seldom found in regular plantations. It is grown in an area of 97,536 ha with annual production of 348 million fruits and productivity of 3,568 fruits per ha in India (Anonymous, 2011). It is grown in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Orissa, West Bengal, Goa, Assam, Andaman and Nicobar Islands (Reddy et al., 2004). Jackfruit is popular fruit and ranks third in total annual production after mango and banana in South India. Karnataka produces approximately 2.60 lakh tonnes per annum in an area of about 11,333 ha mostly in the Southern plains and the Western Ghats (Morton, 1987). The popularity of jackfruit as a commercial crop is

meager due to wide variation in the fruit quality, the long gestation period of plants raised from seeds, the absence of commercial method of vegetative propagation and the widespread belief that excessive consumption of bulbs leads to certain digestive ailments (Samaddar, 1985).

Jackfruit is popular in the Eastern and Southern parts of India. Flakes or bulbs of ripe fruit are rich in nutritive value containing carbohydrates (18.9 g), minerals (0.8 g), vitamin A (30 IU) and thiamine (0.25 mg) for every 100 g (Samaddar, 1985). Due to its richness in nutritive value, jackfruit is called the 'poor man's food' in Eastern and Southern part of India. Productivity of the crop is relatively high (25.71 t/ha).

Jackfruit is not an easy to use fruit and it is difficult to separate the edible fruit bulbs from rind. This difficulty has its origin in morphological and/or biochemical hindrances associated with the fruit. Further, the ripened fruit in the fresh form is not liked by many due to its intense flavour (Bhatia, 1953). Therefore, it is necessary to process this underutilized fruit into easily marketable products.

Being highly cross pollinated and mostly seed propagated, the jackfruit has innumerable types or forms with different fruit characteristics. The types differ among themselves in the shape and density of spikes on the rind, bearing, size, shape, latex, flake size, flake colour, quality and period of maturity. Large variations in sweetness, acidity, flavour and taste have been observed in jackfruit growing areas.

Interestingly, it is difficult to convert fruits of all jackfruit trees into a variety of products due to immense variation of plant types in physical and biochemical qualities of fruits. Fruits of some trees suitable for dessert purpose may not be suitable for making chips due to variation in their biochemical composition. In North Canara and South Canara districts of Karnataka (situated in Western Ghats), people have identified in their region some jackfruit varieties suitable for dessert or for making chips or other utility.

Preservation of fruits by processing has been the research pursuit of many developed and developing countries and has yielded quite a number of technologies. Chips are the most popular snack item in many fast food outlets and jackfruit chips may also be easily salable snack food in the market. For longer shelf life, crispiness and quality, the moisture content of the chips is the most important factor. Visual colour is one of the important quality criteria as far as consumers' preference is concerned and the cost of chips is also a factor that determines commercial value (Anand *et al.* 1982). The pre-requisite to capture exports market for chips is to give a minimum shelf-life of 3 months. Since, chips being porous with very low bulk-density, the head space oxygen normally present in a unit pack is sufficient to cause oxidative rancidity and spoil the product. Further, the sharp edges of the product require puncture resistant packing material. The present study aimed at optimizing temperature and time of deep fat frying to obtain quality jackfruit chips.

MATERIALS AND METHODS

Materials

Well matured, unripe jackfruits of three genotypes viz., *Mottama Varika*, *Swarnahalasu* and *Tane Varika* were brought from the Division of Horticulture, University of Agricultural Sciences, Bangalore. The fresh deseeded bulbs of three different varieties Tane Varikka, Muttom Varikka and Swarnahalasu of jackfruits were taken for preparation of chips. Care was taken to select fresh, mature and unripe jackfruits for experimentation. Sunflower oil, salt and dry chilli powder mix was procured from the local market. The different packaging materials were procured from Bengaluru City Market. The chemicals used in this study were of analytical grade.

Identification of suitable jackfruit genotypes for chips production

The three jackfruit genotypes namely, Tane Varikka, Muttom Varikka and Swarnahalasu grown in Southern Karnataka were selected to check their suitability for chips production. Primarily, the identification criteria for jackfruit varieties for chips production were based on jackfruit size and maturity period, bulb characteristics such as size, color and texture of the jackfruit bulbs. Based on preliminary trial, the bulbs from three genotypes of jackfruit viz., Tane Varikka, Muttom Varikka, Swarnahalasu were selected.



Figure 1: Jackfruit Bulbs of (a) Tane Varikka, (b) Muttom Varikka and (c) Swarnahalasu Genotypes

Extraction of Edible Bulbs from Jackfruit

The edible bulbs from the three jackfruit genotypes Tane Varikka, Muttom Varikka, Swarnahalasu were extracted by manual cutting. The fruits were cut along their equatorial axis with the help of a sharp stainless steel knife smeared with edible oil. The bulbs were then carefully separated from the rind and placenta. Care was taken to handle the bulbs with minimum damage. The freshly extracted whole bulbs were deseeded and sliced as per the required size by using Jackfruit chips making machine. The bulb slices were taken for physical and biochemical analysis whenever required.

Preparation of Jackfruits Chips

The jackfruit chips production process flow chart is presented in below. The fresh bulbs were sliced using jack cutting machine to obtain finger chips of size approximately 15×40 mm. The cut bulb slices were blanched in hot water of 90°C, containing 0.1% of KMS for 5 minutes followed by draining at room temperature for 15 min. A drained bulb slices (250 g) were deep fat fried using cooking grade sunflower oil. The Slice: Oil Ratio was maintained constant at 1:4 for all frying trials at three different temperatures namely, 160, 180 and 200°C for three different frying time periods 6, 7, 8 min. The mixture of salt and dry chili powder at the ratio of 2:1 @ 8 g/100 g was added to the fried chips.

Frying Treatments

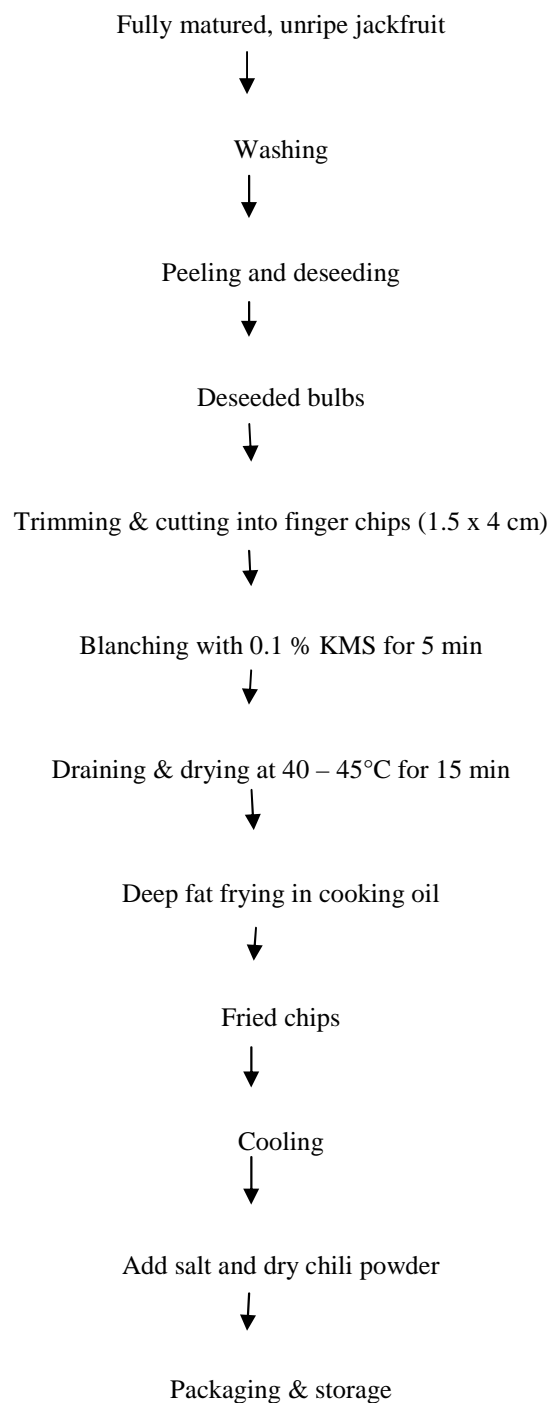
- Frying temperature - 160°C, 180°C and 200°C
- Frying time - 6, 7 and 8 min.

Ingredients for Jack Chips: Well matured, unripe deseeded bulbs, cooking oil, chilli powder / salt, potassium metabisulphite

Sensory Evaluation

The organoleptic quality of jackfruit chips was evaluated by a 9 judge's panel for sensory attributes such as

colour/appearance, crispiness, taste, flavor and overall acceptability. In order to identify the best packaging material to store the jackfruit chips, numerical scoring using 5 point hedonic scale (Ranganna, 1986) was adopted for evaluating the products. The samples were ranked for quality parameters from higher to lower in descending order of acceptability. Organoleptic qualities such as crispiness, taste, flavor, color and overall acceptability of chips were evaluated and are given in Tables 1, 2 & 3.



Process Flow Chart for the Preparation of Jackfruit Chips



Figure 2: Jack Fruit Chips

RESULTS AND DISCUSSIONS

The influence of deep fat frying temperature and time on sensory quality of chips prepared from *Mottama Varika* is presented in Table 1. The results revealed that the chips processed at 180°C for 7 minutes showed highest organoleptic characters with respect to color (4.43), crispiness (4.31) and overall acceptability (4.06) compared to chips processed at other temperature and time combinations. Similarly, with *Tane Varika* genotype also, the chips processed at 180°C for 7 minutes showed highest organoleptic characters (Table 2) with respect to color (4.55), crispiness (4.3) and overall acceptability (4.22). In case of genotype also *Swarnahalasu*, the chips processed at 180°C for 7 minutes showed organoleptic characters with respect to color (3.43), crispiness (3.40) and overall acceptability (3.74). It is clear from the tables that all genotypes do not yield jack chips with high sensory scores. For eg., the chips from *Tane Varika* genotype, recorded better sensory scores when compared to other two genotypes and this is general trend that some genotypes are better suited for chips production than others.

Table 1: Influence of Frying Temperature and Time on Sensory Quality of Jackfruit Chips Processed from the Genotype of *Mottama varika*

Quality Characteristics	Frying Temperature (°C)								
	160°C			180°C			200°C		
	Frying Time (min)								
	6min	7 min	8 min	6 min	7 min	8 min	6 min	7 min	8 min
Colour/Appearance	4.35	4.35	4.21	4.21	4.43	4.30	4.21	4.28	4.05
Crispiness	3.42	3.35	3.64	3.28	4.31	3.92	3.50	3.55	3.60
Flavour	3.42	3.35	3.07	3.21	3.69	3.20	3.28	3.33	3.31
Taste	3.92	3.78	3.00	3.57	3.93	3.50	3.58	3.68	3.69
Overall Acceptability	3.71	3.50	3.57	3.5	4.06	3.50	3.50	3.55	3.58

(Hedonic scale : Excellent-5, Very good-4, Good-3, Fair-2, Poor-1)

Table 2: Influence of Frying Temperature and Time on Sensory Quality of Jackfruit Chips Processed from the Genotype of *Tane Varika*

Quality Characteristics	Frying Temperature (°C)								
	160°C			180°C			200°C		
	Frying Time (min)								
	6min	7 min	8 min	6 min	7 min	8 min	6 min	7 min	8 min
Colour/Appearance	4.0	4.33	4.33	4.22	4.55	4.27	4.27	3.94	4.05

Table 2: Contd.,									
Crispiness	4.2	4.3	4.3	3.7	4.3	4.1	4.1	4.1	4.2
Flavour	3.88	4.27	3.55	3.94	4.16	3.61	4.11	3.83	3.94
Taste	3.83	4.11	4.11	4.00	4.11	3.77	4.16	3.88	4.33
Overall Acceptability	4.11	4.33	4.22	4.11	4.22	3.94	4.22	4.22	4.16

Table 3: Influence of Frying Temperature and Time on Sensory Quality of Jackfruit Chips Processed from the Genotype of Swarnahalasu

Quality Characteristics	Frying Temperature (°C)								
	160°C			180°C			200°C		
	Frying Time (min)								
	6min	7 min	8 min	6 min	7 min	8 min	6 min	7 min	8 min
Colour/Appearance	3.31	3.31	3.81	3.56	3.43	3.25	3.15	3.43	3.26
Crispiness	3.31	3.31	3.75	3.56	3.40	3.34	3.15	3.05	3.69
Flavour	2.93	2.93	3.37	3.31	3.87	3.18	3.15	3.58	3.25
Taste	3.09	2.96	3.34	3.43	3.50	3.31	3.15	3.69	3.78
Overall Acceptability	3.31	3.18	3.59	3.46	3.74	2.84	3.15	3.65	3.58

CONCLUSIONS

The results of the study indicated that jackfruit chips processed at 180°C for 7 minutes showed highest organoleptic scores compared to chips processed at other temperatures and time combinations. Among the three genotypes of jackfruit, the chips prepared from the genotype *Tane Varika* recorded highest organoleptic scores and hence adjusted best suitable for chips production.

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